

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An optical scanning device ~~(1)~~ for scanning a first information layer ~~(2")~~ by means of a first radiation beam ~~(4")~~ having a first wavelength ~~(λ_3)~~ and a first polarization ~~(p_3)~~, a second information layer ~~(2)~~ by means of a second radiation beam ~~(4)~~ having a second wavelength ~~(λ_1)~~ and a second polarization ~~(p_1)~~, and a third information layer ~~(2')~~ by means of a third radiation beam ~~(4')~~ having a third wavelength ~~(λ_2)~~ and a third polarization ~~(p_2)~~, wherein said first, second and third wavelengths substantially differ from each other, the device comprising:

a radiation source ~~(7)~~ for emitting said first, second and third radiation beams consecutively or simultaneously,

an objective lens system ~~(8)~~ for converging said first, second and third radiation beams beam on the positions of said first,

second and third information layers, and

a phase structure ~~(24)~~ with a non-periodic stepped profile, arranged in the optical path of said first, second and third radiation beams, the structure including a plurality of steps (j) with different heights (h_j) for forming said non-periodic stepped profile, ~~characterised in that~~ wherein:

said phase structure ~~(24)~~ includes birefringent material sensitive to said first, second and third polarizations; ~~(p_1, p_2, p_3)~~ ~~(p_1, p_2)~~ and

said stepped profile is designed for introducing a first wavefront modification ~~(ΔW_1)~~ , a second wavefront modification ~~(ΔW_2)~~ and a third wavefront modification ~~(ΔW_3)~~ for said first, second and third wavelengths ~~$(\lambda_1, \lambda_2, \lambda_3)$~~ , respectively, wherein at least one of said first, second and third wavefront modifications is of a type different from the others and at least one of said first, second and third polarizations ~~(p_1, p_2, p_3)~~ differs from the others; and

said heights (h_j) are further designed such that relative step heights $(h_{j+1} - h_j)$ between adjacent steps $(j, j+1)$ include a relative step height having an optical path substantially equal to $a\lambda_1$, wherein "a" is an integer and $a > 1$ and " λ_1 " is said second

wavelength.

2. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 1, wherein said first wavefront modification ~~(AW₁) is comprises~~ substantially of the type(s) of at least one of a spherical aberration and/or and defocus.

3. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 1, wherein said second wavefront modification ~~(AW₁) is~~ substantially flat.

4. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 3, wherein said third wavefront modification ~~(AW₂) is~~ substantially flat.

5. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 4, wherein said stepped profile is further designed for introducing substantially identical phase changes ~~(λ_1 , λ_2)~~ for both said second and third wavelengths ~~($\Delta\Phi_1$, $\Delta\Phi_2$)~~, and wherein said third polarisation ~~(p₂)~~ polarization differs from said

second polarisation (p₁) polarization.

6. (Currently Amended) An optical scanning device ~~(1)~~ according to Claim 5, for scanning a first information layer by means of a first radiation beam having a first wavelength and a first polarization, a second information layer by means of a second radiation beam having a second wavelength and a second polarization, and a third information layer by means of a third radiation beam having a third wavelength and a third polarization, wherein said first, second and third wavelengths substantially differ from each other, the optical scanning device comprising:

a radiation source for emitting said first, second and third radiation beams consecutively or simultaneously,

an objective lens system for converging said first, second and third radiation beams beam on the positions of said first, second and third information layers, and

a phase structure with a non-periodic stepped profile, arranged in the optical path of said first, second and third radiation beams, the structure including a plurality of steps with different heights for forming said non-periodic stepped profile,

wherein:

said phase structure includes birefringent material sensitive to said first, second and third polarizations;

said stepped profile is designed for introducing a first wavefront modification, a second wavefront modification and a third wavefront modification for said first, second and third wavelengths, respectively, wherein at least one of said first, second and third wavefront modifications is of a type different from the others and at least one of said first, second and third polarizations differs from the others; and

wherein ~~the~~ an extraordinary refractive index (n_e) of said birefringent material substantially equals $1 + \frac{\lambda_c}{\lambda_b}(n_o - 1)$, where " n_o " is ~~the~~ an ordinary refractive index of said birefringent and " λ_b " and " λ_c " are either said second and third wavelengths ~~(λ_1 , λ_2)~~, respectively, or said third and second wavelengths ~~(λ_2 , λ_1)~~, respectively.

7. (Currently Amended) ~~An~~ The optical scanning device (1) according to Claim 3, wherein said third wavefront modification

~~(AW₂)~~ is substantially of the same type as said first wavefront modification ~~(AW₃)~~.

8. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 7, wherein said stepped profile is further designed for introducing substantially identical phase changes ~~(ΔΦ₂, ΔΦ₃)~~ for both said first and third wavelengths ~~(λ_{3T}, λ₂)~~, and wherein said third polarisation ~~(p₂)~~ polarization differs from said first ~~polarisation (p₁)~~ polarization.

9. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 8, wherein the extraordinary refractive index (n_e) of said birefringent material substantially equals $1 + \frac{\lambda_c}{\lambda_o} (n_o - 1)$, where "n_o" is the ordinary refractive index of said birefringent and "λ_o" and "λ_c" are either said first and third wavelengths ~~(λ_{3T}, λ₂)~~, respectively, or said third and first wavelengths ~~(λ_{3T}, λ₂)~~, respectively.

Claim 10 (Canceled)

11. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 1, wherein said phase structure ~~(24)~~ is generally circular and said steps ~~(j)~~ are generally annular.

12. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 1, wherein said phase structure ~~(24)~~ is formed on a face of a lens of said objective lens system ~~(8)~~.

13. (Currently Amended) ~~An~~ The optical scanning device ~~(1)~~ according to Claim 1, wherein said phase structure ~~(24)~~ is formed on an optical plate provided between said radiation source ~~(7)~~ and said objective lens system ~~(8)~~.

14. (Currently Amended) ~~An~~ The optical scanning device according to Claim 13, wherein said optical plate comprises a quarter wavelength plate or a beam splitter.

15. (Currently Amended) A phase structure ~~(24)~~ for use in an optical scanning device ~~(1)~~ for scanning a first information layer

~~(2")~~ by means of a first radiation beam ~~(4")~~ having a first wavelength ~~(λ_2)~~ and a first polarization ~~(p_2)~~, a second information layer ~~(2)~~ by means of a second radiation beam ~~(4)~~ having a second wavelength ~~(λ_1)~~ and a second polarization ~~(p_1)~~, and a third information layer ~~(2')~~ by means of a third radiation beam ~~(4')~~ having a third wavelength ~~(λ_2)~~ and a third polarization ~~(p_2)~~, wherein said first, second and third wavelengths substantially differ from each other, the phase structure being arranged in the optical path of said first, second and third radiation beams and having a non-periodic stepped profile, ~~characterised in that~~ wherein:

said phase structure ~~(24)~~ includes birefringent material sensitive to said first, second and third polarizations; ~~(p_2 , p_1 , p_2)~~ and

said stepped profile is designed for introducing a first wavefront modification ~~(ΔW_2)~~, a second wavefront modification ~~(ΔW_1)~~ and a third wavefront modification ~~(ΔW_2)~~ or said first, second and third wavelengths ~~(λ_2 , λ_1 , λ_2)~~, respectively, wherein at least one of said first, second and third wavefront modifications is of a type different from the others and at least one of said first, second

and third polarizations ~~(p_3 , p_1 , p_2)~~ differs from the others; and
the phase structure includes a plurality of steps with
different heights for forming said non-periodic stepped profile,
said heights (h_j) being further designed such that relative step
heights ($h_{j+1}-h_j$) between adjacent steps ($j, j+1$) include a relative
step height having an optical path substantially equal to $a\lambda_1$,
wherein "a" is an integer and $a>1$ and " λ_1 " is said second
wavelength.

16. (Currently Amended) A lens ~~(17)~~ for use in an optical scanning device ~~(1)~~ for scanning a first information layer ~~(2'')~~ by means of a first radiation beam ~~(4'')~~ having a first wavelength ~~(λ_3)~~ and a first polarization ~~(p_3)~~, a second information layer ~~(2)~~ by means of a second radiation beam ~~(4)~~ having a second wavelength ~~(λ_1)~~ and a second polarization ~~(p_1)~~, and a third information layer ~~(2')~~ by means of a third radiation beam ~~(4')~~ having a third wavelength ~~(λ_2)~~ and a third polarization ~~(p_2)~~, wherein said first, second and third wavelengths substantially differ from each other, the lens being provided with a phase structure according to Claim 15.